DISTRIBUTED ANCHOR DENB SOLUTION FOR MOBILE RELAY

FIELD OF THE INVENTION

[0001] The present invention relates to an apparatus, a method, a system, and a computer program product related to (mobile) relay systems. More particularly, the present invention relates to an apparatus, a method, a system, and a computer program product for distributing traffic in a mobile relay system.

BACKGROUND OF THE INVENTION

ABBREVIATIONS

[0002] 3GPP 3rd generation partnership project
[0003] BW BandWidth
[0004] DeNB Donor eNB
[0005] eNB Base station
[0006] EPC Enhanced Packet Core
[0007] GW Gateway
[0008] HO Handover
[0009] IP Internet Protocol
[0010] LTE Long Term Evolution
[0011] LTE-A LTE-advanced
[0012] MME Mobility Management Entity
[0013] MR Mobile Relay
[0014] NGMN Next generation mobile networks
[0015] O&M, OAM Operation & Maintenance
[0016] P-GW PDN Gateway
[0017] PDN Packet Data Network
[0018] Rel Release
[0019] RN Relay Node
[0020] S1 Interface between E-UTRAN and EPC
[0021] S-GW Serving Gateway
[0022] UE User Equipment
[0023] E-UTRAN Evolved Universal Terrestrial RAN
[0024] X2 Interface between eNBs

[0025] This invention is targeted for 3GPP LTE-A Rel'11 and beyond, addressing the mobile relay (MR) for possible evolution of the fixed relay specified in Rel'10 in order to provide enhanced cellular access and IP services for mobile users aboard of populated public transportation such as passenger trains, ferries or cruise ships.

[0026] 3GPP is discussing Mobile Relay for Rel-11. Several possible architecture options are proposed in ([1]) and Alt 2 in ([1]) was chosen as fixed relay architecture for Rel-10. Therefore, the proposal "Alt.2" defined in Section 2.2 of ([2]) is advantageous in which it provides full backwards compatibility to Rel-10.

[0027] In proposal "Alt.2", the MR's SGW/PGW resides in the 1st DeNB ("Anchor DeNB") to which the MR is connected during startup. When the MR is moving away of the Anchor DeNB, it connects to a new serving DeNB. But the MR's traffic (including its own OAM traffic, the 2G/3G/LTE UE's signalling and user traffic) still go back to the Anchor DeNB. This poses a high requirement to the backhaul in the Anchor DeNB, as may be seen from the following example:

[0028] Each train has a Mobile Relay (MR).

[0029] 50 trains start from the central station. Note: A big station has even more trains.

[0030] NGMN ([3]) requires 150 Mbps DL and 50 Mbps UL backhaul for a LTE cell using 20 MHz BW carrier

[0031] For DL traffic received from UE's SGW, the Anchor DeNB need to transmit it to the MR's serving DeNB. For UL traffic received from the MR's serving DeNB, the Anchor DeNB transmits them to UE's SGW. So for each MR, the Anchor DeNB requires a 200 Mbps (i.e. 150+50) backhaul.

[0032] The normal eNB with 3 sectors only requires a 450 Mbps backhaul. In order to support 10 Gbps backhaul for the Anchor DeNB, the operators need to upgrade their transport network, which is not seen desirable. Therefore, the super backhaul problem needs to be solved in order to make "Alt.2" more attractive.

[0033] There are several known options to address the super backhaul issue:

[0034] When the MR leaves the station, it may detach from the Anchor DeNB, then attach to a new DeNB, thus not requiring the super backhaul for the DeNB at the station. However, there are UEs on the train. When the MR performs detach procedure, the UEs' services are disconnected. This causes a bad "out of service" experience to the UEs.

[0035] According to another known option, the operator deploys more DeNBs at the station. For example, the operator deploys 10 DeNB in previous example. Each DeNB requires a 1 GMbps backhaul. But since all 10 DeNBs are installed at the station, this still require the operator to have a 10 Gbps backhaul to the station.

[0036] According to another method, additional signalling is required to setup an offload PDN connection in an offload DeNB, switch LTE traffic to the offload DeNB and relocate the Relay-GW to the offload DeNB. When implementation details are taken into account, some additional signalling (e.g. Path Switch Request) is needed for every UE connected to MR, which may introduce significant signalling overhead.

[0037] [1] TR 36.806, v9.0.0, "Relay architectures for E-UTRA (LTE-Advanced), March 2010

[0038] [2] R3-120423 Offline discussion on mobile relay architecture options

[0039] [3] Next Generation Mobile Networks, Optimised Backhaul Requirements, Aug. 14, 2008

SUMMARY OF THE INVENTION

[0040] It is an object of the present invention to improve the prior art.

[0041] According to a first aspect of the invention, there is provided an apparatus, comprising requesting means adapted to request a group identifier of a cooperative group of network nodes providing a gateway function for the apparatus from a network control server, wherein the request comprises a selection criterion; indicating means adapted to indicate the group identifier of the selected cooperative group received from the network control server to an access network node or a mobility management entity of the apparatus.

[0042] In the apparatus, the selection criterion may comprise at least one of a direction into which the apparatus intends to move, a destination to which the apparatus intends to move, a current area where the apparatus is currently located, and a type of transport means on which the apparatus is installed.

[0043] The apparatus may further comprise interfacing means adapted to interface with the access network node via plural interfaces, wherein each of the interfaces is related to a different one of the network nodes of the selected cooperative group; selecting means adapted to select one of the plural interfaces for each user equipment connected to the appara-